REMARKS

Claims 1-13 are pending in the application. Claims 1-11 are rejected. Claims 12 and 13 are withdrawn from consideration. Applicants have cancelled claims 12 and 13 without disclaimer or prejudice. Applicants have amended claims 1, 2 and 6. New claims 14 and 15 are added.

Election/Restrictions

The Examiner acknowledges Applicant's election of Group I, claims 1-11, for examination. The election has been treated as having been made without traverse. In order to advance the prosecution of the present application to allowance, Applicants have cancelled non-elected claims 12 and 13.

Specification

The Examiner objects to the Abstract because it exceeds 150 words. Applicants are submitting a substitute Abstract that meets the USPTO standard.

The Examiner also objects to the specification due to certain typographical errors. Applicants have amended the specification to remove this basis for objection. No new matter is added..

Claim Rejections – 35 U.S.C. § 112

Claims 1-11 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. This rejection is traversed for at least the following reasons.

The Examiner notes that claim 1 states that the mold is moved a distance "h" micrometers, and that the claim also refers to the height of a closed space as being "h" micrometers. The Examiner is uncertain whether these are the identical distances, but has interpreted them as being identical.

At page 13, the application states in paragraphs [0035] that:

> H (micrometers) denotes the maximum height of the above-described space in the direction of movement of the pressing mold. When space is produced with either the upper or lower mold, the maximum height of the space in the direction of movement of the mold is denoted as h (micrometers). Fig. 4 shows the case

> where a closed space 11 is formed between lower mold 2 and preform (glass material) 4. When both the upper mold and the lower mold form closed spaces with the preform, h (micrometers) denotes the sum of the maximum heights of the two spaces.

On the basis of this text, it is clear that the distance "h" is the **maximum** height of a single space, where only one mold has a space, and is the **maximum** height defined by the sum of both spaces, where each mold has a space. The distance moved by the mold is "h," and that is the **maximum** height of a single space (where there is only one space) or the **maximum** height based on the sum of the heights of two spaces.

However, with respect to the original claim, "at least one" (thus possibly both) of the upper and lower molds form a closed space with the preform. Also, the distance "h" is defined as the **maximum** height of "the spaces" in the direction of movement, thereby taking into account the combination of both spaces, if applicable.

In order to make it clear that "h" is the height of only a single space or the total height of both spaces, where two spaces exist, the claim has been amended to define the parameter "h" as the **maximum** height of the combined spaces. Thus, Applicants have modified claims 1 and 6 to state that "**a maximum height of the closed spaces formed by the at least one of the upper mold and the lower mold in the direction of the moving of the movable mold is denoted as h micrometers.**" Claim 2 has been modified to refer to "spaces" for consistency.

Claim Rejections – 35 U.S.C. § 103

Claims 1 and 6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al (5,817,161) in view of Nomura (5,188,650) and Ikeda (4,055,615). This rejection is traversed for at least the following reasons.

The invention of the rejected independent claims 1 and 6 concerns a method of manufacturing optical glass elements by press-molding the glass material. The pressing mold comprises an upper mold and a lower mold, at least one being movable vertically and at least one having a shape such that the molding surface forms a closed space with a surface of glass

material. The method claimed comprises applying the glass material between the upper mold and the lower mold, and moving at least one of the upper mold and lower mold at an average moving rate of less than or equal to 10 mm/min at least for a distance h micrometers after the glass material becomes in contact with the upper mold and the lower mold. In both cases, the temperature of the pressing mold is at a predetermined temperature T2 within a range in which the glass material exhibits a viscosity of from $10^{7.4}$ to $10^{10.5}$ poises.

Claim 1 further includes the steps of supplying the glass material at a temperature of less than a temperature at which the glass material exhibits a viscosity of 10^{11} poises and heating the supplied glass material by thermal conduction by means of contact with the upper mold or lower mold on the side on which the space is formed.

Claim 6 further specifies the step of moving is conducted when a temperature of the outer surface of the supplied glass material is higher than the interior of the glass material and the outer surface is at a predetermined temperature T1 within a range in which the glass material exhibits a viscosity of from $10^{7.4}$ to $10^{10.5}$ poises.

Notably, both claims 1 and 6 specify moving of the movable mold for a distance h such that "a maximum height of the closed spaces formed by the at least one of the upper mold and the lower mold in the direction of the moving of the movable mold is denoted as h micrometers."

Takagi et al

The Examiner looks to Takagi et al. for disclosure of a method for manufacturing optical elements. The Examiner notes that Takagi teaches an upper mold and lower mold (col. 2, line 54) where at least one of the molds is vertically movable (col. 3, lines 7-8 and 13-14). The molds have a shape such that when a glass material (1) is in contact with the upper and lower mold, a molding surface of one of the molds forms a closed space (3b) with the surface of the glass material, as disclosed at col. 3, lines 34-35 and illustrated in Figs. 1 and 8. Notably, as discussed at col. 5 and 6 of Takagi et al, there is concern with gas caught in the closed space 3b and Takagi et al teaches at col. 5, line 56, that the high gas pressure is released through a gas passage 3d so that the pressure in the closed space 3b is returned to atmospheric pressure.

Further, this process is followed in a repeated series of pressurizing and pressure-reducing steps, as illustrated in Fig. 2, until a blank 1 is formed into a desired shape of a final product.

The Examiner further notes that Takagi et al. discloses heating the glass material by thermal conduction by contacting with the upper or lower molds on the side on which the space is formed, at col. 3, lines 36-38. The Examiner asserts that the mold is moved for a distance of h micrometers, which occurs after the glass material has come into contact with the upper and lower molds, as explained at col. 2, line 66 - col. 3, line 2 and col. 5, lines 44-46. The Examiner notes that this occurs when the temperature of the pressing mold is at a temperature in which the glass material exhibits a viscosity of $10^{10.2}$ poises and when a maximum height of the space in the direction of the moving of the movable mold is h micrometers, as disclosed at col. 5, lines 44-49.

The Examiner admits that Takagi et al. fails to teach supplying heating glass material and a moving rate of the mold while pressing. The Examiner looks to Nomura and Ikeda for such teachings.

Nomura

The Examiner asserts that Nomura teaches a vertically slidable mold used for pressing optical elements, as disclosed at col. 2, lines 48-52 where glass material is supplied at a temperature less than a temperature at which the glass material exhibits a viscosity of 10^{11} poises as disclosed at col. 4, lines 31-36. This reference is only cited for a molding process for a spherical glass blank by pre-heating the blank to a temperature within the range of 10 to 12^{-11} poises in terms of glass viscosity.

Ikeda

The Examiner points to Ikeda for a teaching of a press mold that moves at a speed less than 10 mm/min. at col. 4, lines 5-6. Significantly, Ikeda is in a completely different art, as it concerns the manufacturing of an **electrical resistor** by molding powders of various non-glass materials.

Argument

As explained in the Background of the Invention at page 2 and 3 of the present application, a variety of techniques for removing the gas pressure are disclosed, including the technique of temporarily releasing the molding pressure and then reapplying the pressure in Japanese unexamined patent publication 6-9228. The present invention is derived in order to permit the discharge of gas without the need for grooves, notches or center holes, and without the need to generate a vacuum during press molding. Further, repeated pressing and releasing, which is highly inefficient, is not required.

According to the present invention, the preform is heated while in contact with the pressing mold and the rate of movement of the mold at the start of pressing is controlled to permit press molding with essentially no gas remaining in the space, permitting the manufacture of optical glass elements with good shape precision and high efficiency. As explained at page 15,

> When the gas in the space has been discharged ad the preform has been molded into an optical element of desired thickness, the pressure on the preform is released. Subsequently, the molded glass article is cooled at a rate that does not result in deterioration of surface precision, separated from the upper mold and removed from the lower mold.

This teaching suggests a single movement of the mold and a single discharge of gas, resulting in a highly efficient manufacturing process.

Clearly, Takagi et al. does not concern such technique, as a cycle of repeated pressure and release is required, as illustrated in Fig. 2 of the reference. Nothing in Takagi et al. indicates a problem with such repeated action in a cycle or a desire to have only a single pressure application step in the formation of a lens. As mentioned in column 5, line 50 to column 6, line 64, in the method of Takagi, the pressuring operation and the gas discharge operation are repeated several times and with the repeated operations, the gas caught in the closed space 3b escapes by moving upward the pressurizing state 6 and this makes that the pressurizing state 6 does not come in contact with the upper die 3. However, the repeated operations cause

adherence of the glass material with the molding surface and imprecise transfer of the shape of the molding surface to the glass material.

By contrast, in the present invention, since the initial rate of movement of the mold pressing against the preform is made less than or equal to 10 mm/min at least for a distance h micrometers after the glass material becomes in contact with the upper mold and the lower mold, the initial pressure is gradually transmitted to the preform, the surface of the preform facing the space formed between the preform and the mold is gradually deformed, and the gas in the space tends to gradually expand and be discharged to the exterior by a single continuous pressing operation. This represents a significant difference between the present invention and Takagi. Clearly, Takagi teaches away from the present invention.

Nomura has no concern with gas build-up and is merely cited for a molding process for a spherical glass blank by pre-heating the blank to a temperature within the range of 10 to 12^{-11} poises in terms of glass viscosity. This teaching is cited in isolation, without consideration of the fact that it would have no relevance to the repeated step in Takagi et al. and does not concern the combined processes of the present invention. For example, at col. 4, line 65, Nomura describes the upper mold descending by a predetermined amount and then comes to a first stop position where a load of initial pressing pressure is applied for a predetermined first holding time (30 seconds) and thereafter the mold member descends further to a second stop position where the pressure is increased for a second holding time (60 seconds). The upper mold descends to a final stop position thereafter and are held at a third pressing pressure and a temperature range at which the final mold article is formed. This is a multi-step process involving increase in pressure at each step and holding times at each step. Nothing in this reference teaches or suggest an application of this technique to Takagi et al. or to the present invention.

Finally, the patent to Ikeda is wholly inapplicable to the present invention as it does not even concern a glass member.

As would be understood by one of ordinary skill in the art, the molding of glass materials is highly dependent upon a wide variety of factors including temperature, pressure and glass composition. Issues concerning cracking, stressing, crazing and sticking are all of concern when

developing the sequence of steps used for high yield production of accurate glass lens products. The present invention defines processes that achieves these goals. Nothing in the references teach or suggest such processes. Moreover, nothing in the references teaches or suggests their combination to achieve the present invention. To the extent that the Examiner may cobble together bits and pieces from different references, there has been an impermissible use of hindsight.

Applicants respectfully submit that the rejection has been overcome and the claims should be found to be patentable.

Claim 7 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al (5,817,161) in view of Nomura (5,188,650) and Ikeda (4,055,615), and further in view of Marechal et al (4,481,023). This rejection is traversed for at least the following reasons.

Claim 7 depends from claim 6 and would be patentable for the reasons already given. The claim further concerns the step of heating the glass material so that the outer surface of the glass material reaches a temperature T1 in which the glass material exhibits a viscosity of from $10^{7.4}$ to $10^{10.5}$ poises prior to supplying the glass material between the upper mold and the lower mold.

The Examiner admits that none of the other cited references teach this feature. The Examiner looks to Marechal et al. for such teaching, particularly at col. 3, lines 57-60, 63-64 and col. 4, lines 54-56. The Examiner concludes it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the heated glass at Marechal et al. and the processes of Takagi et al., Nomura and Ikeda in order to reduce mold processing time.

First, there is nothing in Marechal et al. that would lead one of ordinary skill in the art to combine the references to Takagi et al., Nomura and Ikeda. Secondly, there is nothing that would lead one of ordinary skill in the art to preheat the glass material in Takagi et al., as the references concerned with multiple pressure and release steps and would not be concerned with the reduction in processing time, as suggested by the Examiner. Even if such concern existed, there is no teaching or suggestion as to why the heating of the outer surface of the glass material prior to supplying the glass material to the molds, would be desirable. The only teachings in

Marechal et al. concern heating of the entire glass preform, and does not concern heating the outside surface to a predetermined temperature.

Accordingly, the claim would be patentable over the cited art.

Claims 2 and 8 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al (5,817,161) in view of Nomura (5,188,650), Ikeda (4,055,615) and Marechal et al (4,481,023), and further in view of Kataoka et al (5,904,747). . . This rejection is traversed for at least the following reasons.

These claims would be patentable for reasons given with regard to their parent claims. Further, nothing in the added reference to Kataoka et al. would remedy the deficiencies of the other four cited references, as already explained. The Examiner admits that the other references do not mention a radius of curvature. Kataoka et al. is cited for teaching of a mold with a concave surface with a radius of curvature R1 that is smaller than the radius of curvature of the glass material, which has a convex surface, which forms a closed space with a mold, as shown in Fig. 7. Nothing in the reference would teach or suggest the combination of steps and limitations as set forth in the rejected claims 2 and 8. Therefore, these claims would be patentable over the prior art.

Claims 3, 4, 9 and 10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al (5,817,161) in view of Nomura (5,188,650), Ikeda (4,055,615) and Marechal et al (4,481,023). This rejection is traversed for at least the following reasons.

Claims 3 and 9 call for a pressure to be increased on or after the time that the moving distance of the mold reaches a distance h micrometers. This feature is taught at page 15 of the specification. Claims 4 and 10 further define the increased pressure of parent claims 3 and 9, respectively.

Claims 3, 4, 9 and 10 would be patentable for reasons already given with regard to their parent claims 2 and 7. Moreover, there is no teaching or suggestion in any of the reference for increasing the pressure after a distance h has been traveled. Generally, in Takagi et al, the pressure is reduced during the cycling of pressure, rather than increased. While Nomura does

teach changing pressures, as illustrated in the flowcharts of Figs 7A and 7B, this is not a single pressing step, as taught in the present invention.

Claims 5 and 11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al (5,817,161) in view of Nomura (5,188,650), Ikeda (4,055,615) and Marechal et al (4,481,023). This rejection should be traversed for at least the following reasons.

These claims would be patentable for reasons given with regard to their parent claims 4 and 10. The Examiner considers the two-step process of Takagi et al. to indicate an increase in the moving rate of the mold "from zero to moving" after the mold has moved the distance h.

This analysis involves a distortion of the clear meaning of the claim. Accordingly, these claims should be patentable.

New Claims

Applicants have added new claims 14 and 15, which depend from claims 1 and 6 and specify that the moving step is a single step, as taught in the present application.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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